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# **Gas Turbine Power Conversion Systems for Modular HTGRs**

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## **FOREWORD**

The IAEA has been fostering the exchange of information and cooperative research on gas cooled reactor technology with the guidance and support of the International Working Group on Gas Cooled Reactors since 1978. During the 1980's, interest and activities in Member States related to gas cooled reactor technology development shifted from the earlier large High Temperature Gas Cooled Reactor (HTGR) plant designs using prestressed concrete reactor vessels to small modular designs using steel reactor vessels.

The Modular HTGR concept originated in Germany in 1979, based primarily around the concept that by limiting thermal power and allowing sufficient heat losses from the reactor vessel, the key safety function of removal of residual heat could be accomplished without need for active systems. The economic viability of the concept is based on the presumption that cost savings from system simplification can offset the small unit size. All of the early modular HTGR designs were based on a Rankine cycle with steam conditions similar to modern fossil plants, except without steam reheat. As the designs advanced, more detailed cost estimates indicated that the steam cycle modular HTGR may not be cost competitive. Optimization studies in the 1990's indicated that considerable cost savings could result from application of a closed Brayton cycle using advances in technology for open cycle gas turbines, compact heat exchangers, manufacturing and electronics. While the resulting gas turbine modular HTGR designs are based on existing technology, the specific configurations and operating environment differ considerably from existing applications. These differences introduce uncertainties and issues that must be understood and addressed in the course of development and deployment of the gas turbine modular HTGR concept.

The information presented in this report was developed from an IAEA Technical Committee Meeting on "Gas Turbine Power Conversion Systems for Modular HTGRs", held from 14-16 November 2000 in Palo Alto, California. The meeting was hosted by the Electric Power Research Institute in Palo Alto, California, and included participants from national organizations and industries of nine Member States. The TCM provided a forum for participants to discuss and share the status of their individual programmes associated with the design and analysis of systems and components for gas turbine modular HTGR power conversion systems.

The IAEA officer responsible for this publication was J. Kendall of the Division of Nuclear Power.

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